

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for March, 1901, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: regular stations of the Weather Bureau, 159; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Canadian Meteorological Service, 32; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rica Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Commander Chapman C. Todd, Hydrographer, United States

Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Captain François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores, and W. M. Shaw, Esq., Secretary, Meteorological Office, London.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30' or 10^h 30^m west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now always reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

March completed a three-months period of exceptionally severe storms over the North Atlantic Ocean. Forecasts of the direction and force of the wind along the transatlantic steamer routes west of the Banks of Newfoundland were made daily during the month and published on the weather maps issued at Boston, New York, Philadelphia, Baltimore, and Washington. On March 28 advices were issued that steamers westward bound from European ports would encounter hard gales in mid ocean. Reports from shipmasters show that the daily forecasts and storm advices were verified.

Severe gales were reported at sea off the north Pacific coast of the United States during the first and third decades of March. The gales which reached the United States were forecast. Along the middle and south coast of California moderate winds prevailed.

Several severe storms crossed the Great Lakes, warnings of which were issued to open ports on Lake Michigan. Heavy snow and high winds prevailed in the States of the upper Mississippi and Missouri valleys and the Lake region on the 19th and 20th. From the 23d to the 25th traffic in Nebraska, Colorado, Wyoming, and western Kansas was blocked by snow, and a loss of cattle on the ranges was reported. Heavy

snow fell in the middle-western States on the 29th. The snowstorms referred to were covered by the daily forecasts and special warnings were issued by the Chicago office of the Weather Bureau of the heavy snow in Nebraska, Colorado, and western Kansas on the 23d, 24th, and 25th.

From the 4th to the 6th a cold wave overspread the country generally east of the Rocky Mountains. Beginning on the 4th, cold wave warnings were displayed in the Ohio Valley, the middle-western and the interior of the southwestern States, and on the morning of the 5th cold wave and frost warnings were issued for the Gulf and South Atlantic States. Warnings of high northerly winds and low temperature in northeastern Mexico were issued on the 5th by the Weather Bureau office at Galveston, Tex. The frosts of the interior of the North Pacific States during the latter part of the month were forecast by the Weather Bureau office at Portland, Oreg.

Attending the movement of a storm from western Texas over the upper Lake region from the 9th to the 11th the western and southwestern States were swept by heavy gales during the 9th and 10th. During the afternoon and night of the 9th severe local storms occurred from northeastern Texas over Arkansas and parts of Tennessee and Kentucky,

and thunderstorms were reported generally in the middle and east Gulf States.

The rivers of the Sacramento Valley, California, continued at a high stage during the month. From the 1st to the 3d a slight freshet occurred in the lower Willamette River. From the 25th to the 27th floods were reported in the streams of Wisconsin, Michigan, and northern Illinois. At the close of the month the Genessee, Mohawk, and Chenango rivers, New York, were swollen by rain and melting snow.

CHICAGO FORECAST DISTRICT.

On the morning of the 4th cold wave warnings were ordered over the southern and eastern parts of the district in advance of a cold wave which developed over the British Northwest on the 3d. The cold wave was very severe for the season, and the information which was given to the public in advance must have been of great value. A number of severe storms passed northeastward from the Rocky Mountain slope over the Lake region. Warnings of the approach of these storms were issued well in advance to open ports on Lake Michigan, and were followed carefully by vesselmen, as no casualties occurred during the month.—*H. J. Cox, Professor.*

SAN FRANCISCO FORECAST DISTRICT.

The month as a whole was rather free from marked disturbances, except in the extreme southern portion of the district. It was particularly fortunate that such weather conditions prevailed, inasmuch as the rivers of the Sacramento Valley, owing to previous warm weather, heavy rainfall, and the rapid melting of snow, were at an exceedingly high stage.—*A. G. McAdie, Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

The storm warnings of the month were verified by gales on or near the north Pacific coast. The frosts and freezing temperatures in the eastern part of the district during the latter part of the month were, as a rule, successfully forecast. A slight freshet in the lower Willamette River from the 1st to 3d was accurately forecast.—*Edward A. Beals, Forecast Official.*

RIVERS AND FLOODS.

During the month much more rain fell over the Mississippi watershed than during February, 1901, and, as a consequence, the Mississippi River and its tributaries were decidedly higher, particularly during the latter half of the month. The breaking up of the ice in the upper Missouri and upper Mississippi rivers and the melting snows also largely assisted in augmenting the stages of the rivers. The rivers of Wisconsin and Michigan were in flood during the last week of the month owing to the general rains and the thaw from the 22d to the 24th, inclusive. Ice gorges formed in many places; the smaller streams overflowed their banks, causing much damage to low-lying property; dams were washed away; a large number of bridges was either materially weakened or else carried entirely away, and railroad tracks washed away in some places.

The rise in the Ohio was of immense benefit to the navigation interests, and it is said that about 10,000,000 bushels of coal left Pittsburg for southern points.

The Illinois River, at Peoria, Ill., was above the danger line from the 14th to the 31st, inclusive, but was not so high below.

The rivers of the Gulf and Atlantic systems were also much higher than during February. Those of North Carolina were near or above the danger lines from the 27th to the 29th, inclusive, while those of South Carolina were consider-

ably above. The usual flood warnings were issued twenty-four hours in advance. A warning of a 30-foot stage in the Savannah River, at Augusta, Ga., was issued on the 26th, and a stage of 29.6 feet was recorded on the morning of the 28th.

The following report on the moderate floods in the rivers of eastern Alabama and northwestern Georgia was prepared by Mr. F. P. Chaffee, Official in Charge of the United States Weather Bureau office at Montgomery, Ala.:

Heavy to very excessive rains set in over the upper portions of the watershed on the morning of March 25. Rome, Ga., reporting at noon that 4.41 inches had fallen since 8 a. m. Special 2 p. m. reports were immediately called for from all substations; which showed that up to that hour 1.36 inch had fallen at Canton, Ga.; 2.05 at Resaca, Ga.; 5.61 at Rome, Ga.; and 3.51 at Gadsden, Ala. Rome, Ga., was wired that a 26-foot stage was expected at that place by the morning of the 28th, warning issued for moderate flood stages at Gadsden and Lock No. 4, Ala., and for rapid rises at Wetumpka, Montgomery, and Selma, Ala., and advising that stock be moved from low grounds, and other necessary precautions taken. During the twenty-four hours ending at 8 a. m. of the 26th, 2.42 inches of rain had fallen at Canton, Ga.; 2.79 at Resaca, Ga.; 6.22 at Rome, Ga.; 4.41 at Lock No. 4, Ala.; and considerably less at points lower down, causing such pronounced 24-hour rises as 15.7 feet at Resaca, Ga., 18.4 at Rome, Ga.; 13.5 at Gadsden, Ala.; and 11.7 at Lock No. 4, Ala. Taking into consideration the fact that upon a previous occasion such excessive rains had given even more rapid rises in these rivers, additional warnings were issued for moderate flood stages at all points, except Wetumpka, Ala. The flood crest passed Rome, Ga., during the evening of the 27th, though, on the morning of the 28th, the rivers were still rising south of Wetumpka, Ala., and continued to rise slowly during the 29th; at 8 a. m. of this date, 33.0 feet was reported from Wetumpka, Ala.; 31 feet from Montgomery, Ala., and 31 feet from Selma, Ala. On April 1 moderately heavy rains occurred over the middle and upper watersheds; these rains started a secondary rise, which only slightly augmented the previous one, and a final forecast was then made for stages of 39 feet at Montgomery and 40 feet at Selma, Ala. The flood crest passed Montgomery on the 3d and Selma during the afternoon of the 4th.

The following maximum stages were reached on these rises:

Stations.	Maximum stage.	Danger line.
	<i>Feet.</i>	<i>Feet.</i>
Resaca, Ga.	25.8	25
Rome, Ga.	27.0	30
Gadsden, Ala.	32.0	18
Lock No. 4, Ala.	18.0	17
Wetumpka, Ala.	33.4	45
Montgomery, Ala.	37.4	31
Selma, Ala.	38.5	35

The warnings were widely disseminated by telegraph, telephone, and mail, and through the local press; this office has heard of no damage which a warning could have averted. Large areas of prepared land were inundated, and farming operations entirely suspended in the low grounds drained by these rivers.

Danger-line stages were not reached in the rivers of western Alabama.

Nothing of interest occurred along the rivers of the Pacific coast States, although the lower Sacramento River was above the river danger line of 25 feet at Sacramento, Cal., during the first seven days of the month.

Ice had moved out of all the rivers by the end of the month. At Albany, N. Y., on the Hudson River, the ice moved out quietly on the 22d and 23d without causing any damage. On account of the comparatively low temperature a rapid thaw was prevented, and the water was not sufficiently high to create any serious apprehension. On the 27th it was higher than at any time since the spring of 1900, but was only a little over the docks at that. On the 28th the upper Mohawk River was free from ice. The first boat of season arrived from Newburg, N. Y., on the 28th, and the first one from New York, N. Y., on the 29th.

In the Susquehanna River, at Harrisburg, Pa., the ice went out on the 11th, and at Wilkesbarre, Pa., during the night of the 12th.

In the Missouri River the last ice at Kansas City, Mo., was seen on the 1st, and the last at Omaha, Nebr., on the 16th. It went out at Sioux City, Iowa, on the 11th, at Yankton, S.